Effect of Different Diets on The Development and Morphometric of *Coccinella septempunctata* (Linneous)

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Abstract: A laboratory experiment was carried out to determine the effect of different diets on biology of *Coccinella septemputata* Linneous, in the Department of Plant protection, Sindh Agriculture University, Tando Jam, Pakistan during 2011 and 2012 at 28±2 ºC and 65±5% relative humidity. The result showed that total larval developmental period was recorded 8.0 ± 0.72 and 7.8 ± 0.69 days on grain moth eggs and safflower aphid, respectively, however, no significant difference was recorded between pre-pupal and pupal period on grain moth egg and safflower aphid. The adult longevity of male (43.10 ± 1.04 and 56.50 ± 1.61) and female (36.07 ± 0.24 and 42.50 ± 0.69 days) was significantly different on grain moth eggs and safflower aphid, respectively. The larval instars were not survived on prepared artificial diet, however, only adult male and female survived (68.50 ± 2.03 and 72.90 ± 2.07 days) without fecundity. The result further revealed that the length and breadth (mm) of larval instars, pupa and adults of *C. septempuntata* was significantly varied feeding on grain moth eggs and safflower aphid.

Keywords: *Coccinella septempunctata,* development period, morphometric, artificial diets, safflower aphid and grain moth eggs.

INTRODUCTION

Natural enemies play an important role for the suppression of arthropod pests in field crops [1]. Approximately 400 species of lady bird beetles are present worldwide, however, most of them eating on many soft bodied insects. Ladybird beetles belongs to order coleopteran and family coccinellidae are entomophagous insect that fed on arthropod pests particularly aphid, sugarcane whitefly, mealy bugs, and rice brown plant hoppers [2, 3]. The lady beetle *C. septempunctata* is about 6-7 mm long, oval and dome shaped body with dark reddish wings having seven black spots. The egg is measured 1mm long and larva about 7-8 mm in length [4]. These predatory beetles are designated helpful for field crops in regulating the pest population [5]. In the absence of prey species the coccinellid feed on alternative food like as fungal spores, pollen and nectar for their development [6]. However, they need specific aphid food for egg laying and successful larval development. Aphids feeding on some economically neutral plants may serve as food in mass rearing of *C. septempunctata* for inundative releases [7, 8]. It is also evident that adverse use of agro chemicals caused environmental pollution, human and animal health hazards. Simultaneously, continuous reliance on pesticides created resistance in pests. There was a dire need to conduct the studies on conservation of natural enemies' especially *C. septempunctata* for sustainable management of pests. So in this regard present study was conducted on the quality of different food supplements for larvae of *C. septempunctata* by recording their development and morphometric under laboratory conditions. Hopefully this research work will be of a great help for applied entomologists and mass production laboratories, and the farmers in general for the insect pest management.

MATERIAL AND METHODS

The experiment was conducted in the Department of Plant Protection, Faculty of crop Protection, Sindh Agriculture University, Tando Jam Pakistan during 2011 and 2012 at 26±2ºC and 65±5 % relative humidity (RH). The adult seven spotted lady beetles were collected from different crops and reared on natural hosts under laboratory as stock culture. Natural food, safflower aphid was collected from safflower crop and eggs of Angoumois grain moths was brought from the stock culture of mass rearing laboratory of Nuclear Institute of Agriculture (NIA) Tando Jam, Pakistan. The artificial diet was prepared by adding different ingredient at the rate of 3gm egg yolk; 2gmcasein; 1gm agar; 3gm sucrose; 2gm cholesterol; 3gm protein hydrolysate; 3gm vitamin-E; 1gm yeast; 2gm honey and 0.20gm sodium benzoate (antibiotic). The above ingredients measured on electric micro weight balance. All the ingredients were mixed for 20 minutes until paste

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obtained. The resulting paste, a total of 20 gm of these diets was sealed in aluminum foil and stored at 20˚C. After hatching from eggs the 10 larvae were transferred into new Petridishes for experiment. Each larval instar fed by natural and artificial diets to determine the changes occurred during the development and the length and breadth (mm) was measured with the help magnifying glass with scale till the next subsequent instar. The artificial diet was provided in droplet form to larvae (1^{st} to 4^{th} instars) and adult (male and female). The experiment was conducted designed into complete randomize (CRD) with ten replicates. The observed data was analyzed through statistical software Statistics 8.1 [9].

RESULTS

The result of present study revealed that the developmental period of different life stages of *C. septempunctata* L. reared on natural (Angoumois grain moth eggs and Safflower aphid) and artificial diets (Table **1**). The average development period of the 1^{st}, 2^{nd}, 3^{rd} and 4^{th} instars larvae last about 2.10 ± 0.10, 1.60 ± 0.16, 2.0 ± 0.16, 2.30 ± 0.30; and 1.90 ± 0.10, 1.60 ± 0.22, 1.80 ± 0.20, 2.50 ± 0.17 days when reared on grain moth eggs and safflower aphid, respectively. The total larval developmental period was 8.0 ± 0.72 and 7.8 ± 0.69 days recorded on grain moth eggs and safflower aphid, respectively. Similarly, the pre-pupal period and pupal period were seen 1.10 ± 0.10; 1.10 ± 0.10 days and 2.60 ± 0.16; 2.70 ± 0.15 days on grain moth egg and safflower aphid, respectively. The adult longevity of male and female was observed 43.10 ± 1.04 and 56.50 ± 1.61; 36.07 ± 0.24 and 42.50 ± 0.69 days on grain moth eggs and safflower aphid, respectively.

The result further revealed that the larval instars of predator, *C. septempuntata* L. was not survived on artificial diet, however, only adult survived without fecundity. The adult longevity of male and female was recorded on artificial diets 68.5 ± 2.03 and 72.9 ± 2.07 days, respectively. There was significant difference among the larval instars and adults age of predator at $P<0.05$. The data also indicated the measurement of different life stages presented in Table **2**. The average length and breadth of 1^{st} instar larvae was 1.76 ± 0.10 and 0.47 ± 0.03; 2.25 ± 0.11 and 0.55 ± 0.03 mm, respectively, whereas the average length and breadth of 2^{nd} instar larvae was measured 4.50 ± 0.14 and 0.75 ± 0.04; 5.54 ± 0.14 and 0.93 ± 0.04 mm, respectively, when reared on grain moth egg and safflower aphid. The average length and breadth of 3^{rd} instar larvae was measured 5.68 ± 0.19,0.91 ± 0.03; 7.15 ± 0.10 and 1.41 ± 0.12 mm, respectively, while the average length and breadth in 4^{th} instar larvae was 6.82 ± 0.10 and 1.33 ± 0.08; 8.38 ± 0.14 and 1.82 ± 0.07 mm, respectively, on same food supplements. There was significant difference in length and breadth among different larval instars at $P<0.05$). Furthermore the average length and breadth in pupae was 4.05 ± 0.03 and 2.47 ± 0.16; 5.13 ± 0.12 and 3.71 ± 0.18 mm, respectively. Similarly, the result further revealed that average length and breadth measured for adult male was 4.74 ± 0.20 and 4.15 ± 0.18; 5.64 ± 0.12 and 4.69 ± 0.22 mm, respectively, whereas the average length and breadth in adult female was 5.64 ± 0.20 and 4.77 ± 0.16; 6.71 ± 0.12 and 5.42 ± 0.15 mm, respectively on grain moth eggs and safflower aphid.

DISCUSSION

The maximum age was recorded for 4^{th} instar larva followed by 1^{st}, 3^{rd} and 2^{nd} larval instars of *C. septempunctata* L. However, the pre-pupal and pupal age varied significantly from each other. Similarly, the female live longer than male on same food supplements. Our finding have partial agreements with

Table 1: Developmental Period (Days) of Different Life Stages of *C. septempunctata* Reared on Natural and Artificial Diets under Laboratory Conditions

Life stage	Grain Moth Eggs	Safflower aphid	Artificial Diet
1^{st} instar	2.1± 0.10 ab	1.9 ± 0.10bc	0.00 ± 0.00
2^{nd} instar	1.6 ± 0.16 c	1.6 ± 0.22 c	0.00 ± 0.00
3^{rd} instar	2.0± 0.16 b	1.8 ± 0.20bc	0.00 ± 0.00
4^{th} instar	2.3 ± 0.30 ab	2.5 ± 0.17 a	0.00 ± 0.00
Total Larval Period	8.0± 0.72 a	7.8± 0.69 ab	0.00 ± 0.00
Pre-pupal	1.1 ± 0.10 b	1.1 ± 0.10 b	0.00 ± 0.00
Pupal	2.6 ± 0.16 ab	2.7 ± 0.15 a	0.00 ± 0.00
Adult male	43.1 ± 1.04 c	36.7 ± 0.4 e	68.5 ± 2.03 b
Adult female	56.5 ± 1.61 c	42.5 ± 0.69 cd	72.9 ± 2.07 a

Table 2: Morphometric of Different Life Stages of *Coccinella septempunctata* L. on Natural Diets under Laboratory Conditions

Life stages	Angnomois grain moth egg		Safflower aphid	
	Length (mm)	Breadth (mm)	Length (mm)	Breadth (mm)
1st instar	1.76 ± 0.10	0.47 ± 0.03	2.25 ± 0.11	0.55 ± 0.03
2nd instar	4.5 ± 0.14	0.75 ± 0.04	5.54 ± 0.14	0.93 ± 0.04
3rd instar	5.68 ± 0.19	0.91 ± 0.03	7.15 ± 0.10	1.41 ± 0.12
4th instar	6.82 ± 0.10	1.33 ± 0.08	8.38 ± 0.14	1.82 ± 0.07
Pupa	4.05 ± .0.03	2.47 ± 0.16	5.13 ± 0.12	3.71 ± 0.18
Male	4.74 ± 0.20	4.15 ± 0.18	5.64 ± 0.12	4.69 ± 0.22
Female	5.64 ± 0.20	4.77 ± 0.16	6.71 ± 0.12	5.42 ± 0.15

Rana *et al.* [10] and Muhammed *et al.* [11] who reported that the developmental period of larval instars and adult longevity of *C. septemtunctata* was significantly varied at different prey species. Present finding are also in agreement with Kianpour *et al.* [12] who determined the influence of seven different diets with alternative natural foods as an aphid, *Lipaphis erysimi* and mite, *Tetranychus urticae* on certain biological parameters of *C. septempunctata* under laboratory conditions. The larval and adult duration was prolonged when reared on two days old aphid and mite. There was significant difference between male and female age of adult beetle. The results of present study are supported with Sarwar and saqib [13] who reported that the larvae and adults of *C. septempunctata* L. survived on artificial diet as an alternative food and no reproduction was determined in the absence of preferred aphid prey. The data showed that there was significant difference in length and breadth of male and female on same food supplements. These measurements have the partial agreement with the findings of Seshadri [14] and Patel [15].

REFRENCES

[1] Gilkeson L, Kelin M. Natural enemies of insect pests. Cooperative Extension, Cornell University, Ithea, New York: 2001; p. 63.

[2] Debaraj Y, Sing TK. Biology of an aphidophagousCoccinellid predator, *Coccinella transversalis* Fab. J Biol Control 1990; 4(2): 93-95.

[3] Dixon AFG. Insect Predatory – Prey Dynamics. Ladybird Beetles & Biological Control. Cambridge University Press. 2000; p. 248.

[4] Buchanan GA. Beneficial insects in the home yard and garden. Georgia Ext Pub Bull 1996; 1140: 1-5.

[5] Michaud JP, Qureshi JA. Induction of reproductive diapause in *Hippodamia convergens* (Coleoptera: Coccinellidae) hinges on prey quality and availability. Eur J Entom 2001; 102(3): 483-487. http://dx.doi.org/10.14411/eje.2005.069

[6] Triltsh H. Food remains in the guts of *Coccinella septempunctata* (Coleoptera, Coccinellidae) adults and larvae. Eur J Entom 1999; 96(2): 355-364.

[7] Majerus MEN. Ladybirds Harper Collins Publisher 1994; p. 367.

[8] Hodek I, Honek A. Ecology of Coccinellidae. Kluwer Academic Publishers, Dordrecht 1996; p. 464.

[9] Zar JH. Biostatistical Analysis. Prentice-Hall, Upper Saddle River, NJ, USA 1996; p. 662.

[10] Rana JS, Kakkar J. Biological studies on 7 spot lady bird beetle, *Cocciella septempunctata* L. with creal aphid, *Sitobion avenae* F. as prey. Cereal Res Commun 2000; 28(4): 440-454.

[11] Mohammed E, Nadia, Ghanim A. Biological Characteristics of Three Predatory Insects Preyed on the Silverleaf Whitefly, *Bemisia argentifolii* Bellows and Perring under Controlled Conditions. J Biol Pest Cont Egyptian 2008; 18(2): 309-313.

[12] Kianpour RF, Kamali Y, Karim, Omkar. Effect of mixed prey on the development and demographic attributes of a generalist predator, *Coccinella septempunctata* (Coleoptera: Coccinellidae). Biol Sci Tech 2011; 21(4): 435-447. http://dx.doi.org/10.1080/09583157.2011.554800

[13] Sarwar M, Saqib SM. Rearing of Predatory Seven Spotted Ladybird Beetle *Coccinella septempunctata* L. (Coleoptera: Coccinellidae) on Natural and Artificial Diets Under Laboratory Conditions. Pk J Zool 2010; 42(1): 47-51.

[14] Seshadri SM. The bionomics of coccinellid beetle. (1) *Menochillus sexmaculatus* (2) *Coccinella septempunctata*. *M.Sc* (*Agri*) *thesis*, Gujarat Agriculture University, Sardar Krushinagar, India 1989; p. 15.

[15] Patel DP. Bionomics and predatory potential of *M. sexmaculatus* Fab. And *C. carnea* St. reared on maize aphid (*Rhopalosiphum maidis* Fitch) along with their comparative susceptibility to some neem based pesticides. *M.Sc*. (*Agri*) *thesis*, Gujarat Agri. Uni. Sardar Krushinagar, India 1998.

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